BYJU'S EXAM PREP

GATE 2021

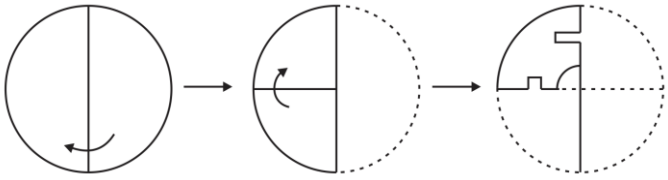
Computer Science & Information Technology

Shift-1

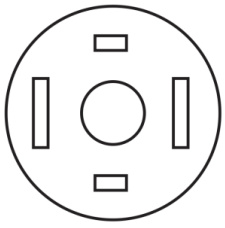
Questions & Solutions

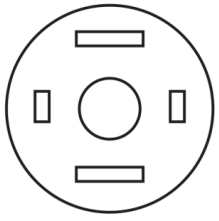
SECTION: GENERAL APTITUDE

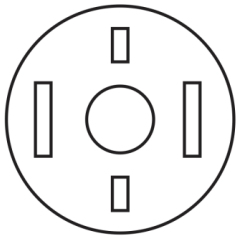
1.

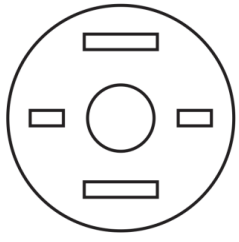


A circular sheet of paper is folded along the lines in the directions shown. The paper, after being punched in the final folded state as shown and unfolded in the reverse order of folding, will look like _____.

A. 

B. 

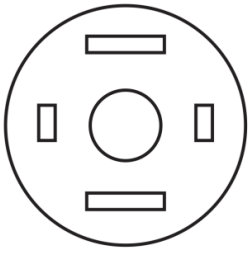
C. 

D. 

[MCQ]

Ans. B

Sol.



2. There are five bags each containing identical sets of ten distinct chocolates. One chocolate is picked from each bag.

The probability that at least two chocolates are identical is _____ .

A. 0.3024 B. 0.4235

C. 0.6976 D. 0.8125

[MCQ]

Ans. C

Sol. Atleast 2 same

Required probability = Total – All different

P(at least 2 same) = 1 – P(all diff)

$$= 1 - \frac{10 \times 9 \times 8 \times 7 \times 6}{10 \times 10 \times 10 \times 10 \times 10} = 0.6976$$

3. Some people suggest anti-obesity measure (AOM) such as displaying calorie information in restaurant menus. Such measures sidestep addressing the core problems that cause obesity: poverty and income inequality.

Which one of the following statements summarizes the passage?

A. AOM are addressing the core problems and likely to succeed.

B. The proposed AOM addresses the core problems that cause obesity.

C. If obesity reduces, poverty will naturally reduce, since obesity causes poverty.

D. AOM are addressing the problem superficially

[MCQ]

Ans. D

Sol. The AOM is not addressing the problem thoroughly or deeply. Only Calorie information can sidestep obesity but not poverty or income inequality.

4. A polygon is convex if, for every pair of points, P and Q belonging to the polygon, the line segment PQ lies completely inside or on the polygon.

Which one of the following is **NOT** a convex polygon?

A. 

B. 

C. 

D. 

[MCQ]

Ans. D

Sol. Option D is a concave polygon and not a convex polygon.

5. We have 2 rectangular sheets of paper, M and N, of dimension 6 cm × 1 cm each. Sheet M is rolled to form an open cylinder by bringing the short edge of the sheet together. Sheet N is cut into equal square patches and assembled to form the largest possible closed cube. Assuming the ends of the cylinder are closed, the ratio of the volume of the cylinder to that of the cube is _____ .

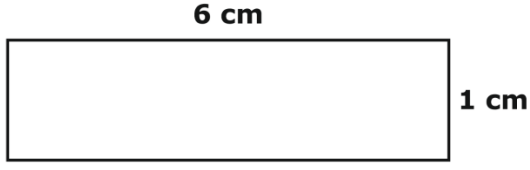
A. $\frac{\pi}{2}$ B. $\frac{9}{\pi}$

C. 3π D. $\frac{3}{\pi}$

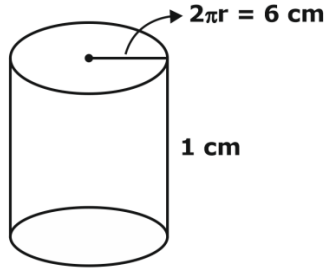
[MCQ]

Ans. B

Sol.

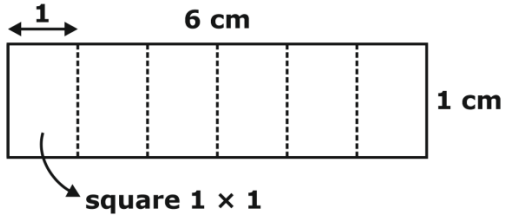


M →Cylindernarrow (1 cm) edges are combined



$V = \pi r^2 h = \pi\left(\frac{6}{2\pi}\right)^2 \times 1 = \frac{9}{\pi}$

N → Cube



Volume of cube = 1 × 1 × 1 = 1

$\frac{V_{cyl}}{V_{cube}} = \frac{9}{\pi} = 2.86$

6.

Items	Cost (₹)	Profit %	Marked Price (₹)
P	5,400	----	5,860
Q	----	25	10,000

Details of prices of two items P and Q are presented in the above table. The ratio of cost of item P to cost of item Q is 3 : 4. Discount is calculated as the difference between the marked price and the selling price. The profit percentage is calculated as the ratio of the difference between selling price and cost, to the cost

$(\text{Profit\%} = \frac{\text{Selling} - \text{Cost}}{\text{Cost}} \times 100)$

The discount on item Q, as a percentage of its marked price, is _____.

A. 25 B. 5

C. 12.5 D. 10

[MCQ]

Ans. D

Sol. $\frac{\text{Cost price of P}}{\text{Cost price of Q}} = \frac{3}{4}$

⇒ Cost price of Q = $5400 \times \frac{4}{3}$ = ₹ 7200

$\frac{\text{Selling price of Q} - \text{Cost price of Q}}{\text{Cost price of Q}} = 0.25$

⇒ Selling price of Q = Cost price of Q * 0.25 + Cost price of Q

⇒ Selling price of Q = 1.25 × 7500 = Rs. 9000

Discount of marked price = 10000 – 9000 = Rs. 1000

Discount (%) = $\frac{1000}{10000} \times 100 = 10\%$

7. The ratio of boys to girls in a class is 7 to 3. Among the options below, an acceptable value for the total number of students in class is

A. 50 B. 73

C. 21 D. 37

[MCQ]

Ans. A

Sol. B : G = 7 : 3

B =	7K
G =	3K
Total	10K

So, possible answer is multiple of 10.

⇒ 50

8. Consider the following sentences:

(i) Everybody in the class is prepared for the exam.

(ii) Babu invited Danish to his home because he enjoys playing chess.

Which of the following is the CORRECT observation about the above two sentences?

A. (i) is grammatically correct and (ii) is ambiguous

B. (i) is grammatically correct and (ii) is unambiguous

C. (i) is grammatically incorrect and (ii) is unambiguous

D. (i) grammatically incorrect and (ii) is ambiguous

[MCQ]

Ans. B

Sol. 1st one is grammatically correct and 2nd one is unambiguous.

9. Given below are two statements 1 and 2, and two conclusions I and II.

Statement 1 : All bacteria are microorganisms.

Statement 2 : All pathogens are microorganisms.

Conclusion I : Some pathogens are bacteria.

Conclusion II : All pathogens are not bacteria.

Based on the above statements and conclusions, which one of the following options is logically CORRECT?

A. Only conclusion II is correct

B. Neither conclusion I nor II is correct.

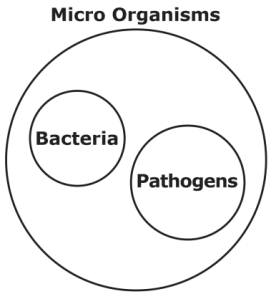
C. Only conclusion I is correct

D. Either conclusion I or II is correct.

[MCQ]

Ans. B

Sol.



C_1:All pathogens are not bacteria.

True, if no intersection.

C_2:Some pathogens are bacteria.

True, if intersection is these.

So, individually both are false .

But neither of C_1 or C_2 is correct.

10. _____ is to surgery is as writer is to _____

Which one of the following options maintains a similar logical relation in the above sentence?

A. Plan, outline

B. Hospital, library

C. Doctor, book

D. Medicine, grammar

[MCQ]

Ans. C

Sol. Doctor is to surgery as writer is to Book.

TECHNICAL

1. Let (M) denote an encoding of an automation M. Suppose that Σ = {0, 1}. Which of the following language is/are NOT recursive?

A. L = {⟨M⟩ | M is a PDA such that L (M) = ∅ }

B. L = {⟨M⟩ | M is a PDA such that L(M) = Σ*}

C. L = {⟨M⟩ | M is a DFA such that L(M) = Σ*}

D. L = {⟨M⟩ | M is a DFA such taht L(M) = ∅ }

[MSQ]

Ans. B

Sol. L = {⟨M⟩ | M is a PDA, L(M) = φ} is Recursive

Emptiness is decidable for PDA

L = {⟨M⟩ | M is a PDA, L(M) Σ*} is not recursive

Totality is not decidable for PDA

L = {⟨M⟩ | M is a DFA, L(M) Σ*} is Recursive

Totality is decidable for DFA

L = {⟨M⟩ | M is a DFA, L(M) = φ} is Recursive

Emptiness is decidable for DFA

2. In the context of operating system, which of the following statements is/are correct with respect to paging?

A. Paging helps solve the issue of external fragmentation.

B. Page size has no impact on internal fragmentation.

C. Multi-level paging is necessary to support pages of different sizes.

D. Paging incurs memory overheads.

[MSQ]

Ans. A,D

Sol. Paging helps solve the issue of external fragmentation

Paging incurs memory overheads.

3. Consider the following ANSI C program.

```
#include <stdio.h>
int main()
{
    int i, j, count;
    count = 0;
i = 0;
    for (j = –3, j <= 3; j++)
    {
        if ((j >= 0) && (i++))
            count = count + j;
    }
    count = count + i;
printf("%d", count);
    return 0;
}
```

Which of one of the following options is correct?

A. The program will compile successfully and output 10 when executed.

B. The program will not compile successfully.

C. The program will compile successfully and output 8 when executed.

D. The program will compile successfully and output 13 when executed.

[MCQ]

Ans. A

Sol.

j = –3 –3 < = 3	**j = –2 –2 < = 3**	**j = –1 0 < = 3**	**j = 0 0 < = 3**	**j = 1 1 < = 3**	**j = 2 2 < = 3**	**j = 3 3 < = 3**
If() False	False	False	True	True	True	True
–1 > = 0	–2 > = 0	–1 > = 0	(1 > = 0) & (I++)			
0			1	2	3	4
Count			0 + 0 = 0	0 + 1 = 1	1 + 2 = 3	3 + 3 = 6

Finally,

Count = Count + I; = 6 + 4 = 10

So, Program will compile successfully and prints value 10 after execution.

Hence option 'A' correct.

4. Assume that a 12-bit Hamming codeword consisting of 8-bit data and 4 check bits is $d_8d_7d_6d_5c_8d_4d_4d_3d_2c_4d_1c_2c_1$, where the data bits and check bits are given in

Data bits							
d_8	d_7	d_6	d_5	d_4	d_3	d_2	d_1
1	1	0	x	0	1	0	1

Check bits			
c_8	c_4	c_2	c_1
y	0	1	0

Which one of the following choices gives the correct values of x and y?

A. x is 1 and y is 0. B. x is 1 and y is 1.

C. x is 0 and y is 0. D. x is 0 and y is 1.

[MCQ]

Ans. C

Sol.

C_1	C_2	3	C_4	5	6	7	C_8	9	10	11	12
0	1	1	0	0	1	0	y	x	0	1	1

C_1 : 1 3 5 7 9 11

0 1 0 0 x 1

Forever parity X will be 0, X = 0

C_2 : 2 3 6 7 10 11

1 1 1 0 0 1 → even parity

C_4 : 4 5 6 7 12

0 0 1 0 1 → even parity

C_8 : 8 9 10 11 12

y 0 0 1 1

For even parity Y must be Y = 0

Option C is Correct X = 0, Y = 0

5. There are 6 jobs with distinct difficulty levels, and 3 computers with distinct processing speeds. Each job is assigned to a computer such that :

- The fastest computer gets the toughest job and the slowest computer gets the easiest job.
- Every computer gets at least one job

The number of ways in which this can be done is _____ .

[NAT]

Ans. 65

Sol. Let C1 be the fastest and C3 be the slowest computers.

These two are assigned two jobs. Now out of the remaining 4 jobs we need to ensure C2 gets at least

1. Without this constraint we can assign 4 jobs to 3 computers in 34=81 ways. Out of these 81 ways 24=16 will be having no jobs for C2.

So, number of possible ways so that C2 gets at least one job =81−16=65.

6. Let p and q be two propositions. Consider the following two formulae in propositional logic.

$S_1 : (\neg p \wedge (p \vee q)) \rightarrow q$

$S_2 : q \rightarrow (\neg p \wedge (p \vee q))$

Which one of the following choices is correct?

A. Neither S_1 nor S_2 is a tautology.

B. S_1 is not a tautology but S_2 is not a tautology.

C. S_1 is a tautology but S_2 is not a tautology.

D. Both S_2 and S_2 are tautologies.

[MCQ]

Ans. C

Sol. $p \wedge (\sim p \vee q) \rightarrow q$

$\sim(p \wedge (\sim p \vee q)) \vee q$

$\sim((\underline{p \wedge \sim p})) \vee (p \wedge q)) \vee q$

$\sim (F \vee p \wedge q) \vee q$

$(\sim p \vee \sim q) \vee q$

$\sim p \vee (\underline{\sim p \vee p})$

$\sim p \vee T$

$\boxed{T}$

A is Tautology

B:

$q \rightarrow (\sim p \wedge (p \vee q))$

$\sim q \vee (\sim p \wedge (p \vee q))$

$\sim q \vee ((\underline{\sim p \wedge p}) \vee (\sim p \wedge q))$

$\sim q \vee (F \vee (\sim p \wedge q))$

$\sim q \vee (\sim p \wedge q)$

$(\sim q \vee \sim p) \wedge \underset{T}{\underline{(\sim q \vee q)}}$

$\boxed{\sim q \vee \sim p}$

B is not tautology

7. Consider the following context-free grammar where the set of terminals is {a, b, c, d, f}.

$S \rightarrow d\ a\ T \mid R\ f$

$T \rightarrow a\ S \mid b\ a\ T \mid \in$

$R \rightarrow c\ a\ T\ R \mid \in$

The following is a partially-filled LL(1) parsing table.

	a	b	c	d	f	$
S			①	S → d a T	②	
T	T → a S	T → b a T	③		T → ∈	④
R			R → c a TR		R → ∈	

Which one of the following choices represents the correct combination for the numbered cells in the parsing ("blank" denote that the corresponding cells is empty)?

A. ① blank ② S → R f ③ blank ④ blank

B. ① S → R f ③ blank ③ blank ④ T → ∈

C. ① blank ② S → R f ③ T → ∈ ④ T → ∈

D. ① S → R f ② S → R f ③ T → ∈ ④ T → ∈

[MCQ]

Ans. D

Sol. $S \rightarrow d\ a\ T \mid R\ f$

$T \rightarrow a\ S \mid b\ a\ T \mid \varepsilon$

$R \rightarrow c\ a\ TR \mid \varepsilon$

First (S) = {d, c, f}

First (T) = {a, b, ε} ⇒ Follow T) {$, c, f}

1. M[S, c] = S → R f

2. M[S, f] = S → R f

3.M[T, c] = T → ε

4.M[T, $] = T → ε

8. Let G be a group of order 6, and H be subgroup of G such that $1 < |H| < 6$.

Which one of the following options is correct?

A. G is always cyclic, but H may not be cyclic.

B. G may not be cyclic, but H is always cyclic.

C. Both G and H are always cyclic.

D. Both G and H may not be cyclic.

[MCQ]

Ans. B

Sol. As order of group is 6 (given) of according to Lagrange's order of subgroup of group always divides.

i.e. O(G) / O(H)

O(G) = 6 (not a prime no)

So, G is not a cyclic group.

Now, 1 < |H| < 6 so order of H may be 2, 3, 4, 5 but only 2, 3 divides 6 so order of H is either 2 or 3 and both are prime number so H is cycle group.

9. Let P be an array containing n integers. Let t be the lowest upper bound on the number of comparisons of the array elements, required to find the minimum and maximum values in an arbitrary array of n elements. Which one of the following choices is correct?

A. $t > 2n - 2$

B. $t > \lceil \log(n) \rceil$ and $t \le n$

C. $t \ge n$ and $t \le 3\left\lceil \frac{n}{2} \right\rceil$

D. $t > 3\left\lceil \frac{n}{2} \right\rceil$ and $t \le 2n - 2$

[MCQ]

Ans. C

Sol.

Straight – Max Min	Divide and comparisons
Max comp.	$T(n) = \underbrace{\frac{3n}{2} - 2}_{\text{all cases}} \quad n - 1$
(2n – n comp.)	
min comp.	
(n – 1) comp.	

10. Consider the following expression.

$$\lim_{x \to -3} \frac{\sqrt{2x + 22} - 4}{x + 3}$$

The value of the above expression (rounded to 2 decimal places) is_____.

[NAT]

Ans. 0.25

Sol. (0.25)

$$\lim_{x \to -3} \frac{\sqrt{2x + 22} - 4}{x + 3} = \frac{\sqrt{16} - 4}{-3 + 3} = \frac{0}{0} \text{ from}$$

Apply L'Hospital Rule,

$$\lim_{x \to -3} \frac{1}{\frac{2\sqrt{2x + 22}}{1}} \overset{(2)}{=} \frac{1}{2}\sqrt{6} \times 2 = \frac{1}{4} = 0.25$$

11. Consider the following representation of an number in IEEE 754 single-precision floating point format with a bias of 127.

S : 1 E : 10000001 F : 11110000000000000000000

Here S, E and F denote the sign, exponent and fraction components of the floating point representation.

The decimal value corresponding to the above representation (rounded to 2 decimal places) is _____ .

[NAT]

Ans. -7.75

Sol. $(7.75)_{10}$

$N = (-1)^S \times 1.F \times 2^{Exp-127}$

$= (-1)^1 \times 1.111100\ldots0 \times 2^{129-127}$

$= -(1.111100\ldots0) \times 2^2$

$= -(111.1100\ldots0)_2 = -(7.75)_{10}$

12. Consider the following instruction sequence when register R1, R2 and R3 are general purpose and MEMORY [X] denotes the content at the memory location X.

Instruction	Semantics	Instruction Size (bytes)
MOV R1, (500)	R1 ← MEMORY [500]	4
MOV R2, (R3)	R2 ← MEMORY [R3]	4
ADD R2, R1	R2 ← R1+R2	2
MOV (R3), R2	MEMORY [R3] ← R2	4
INC R3	R3 ← R3+1	2
DEC R1	R1 ← R1–1	2
BNZ 1004	Branch if not zero to the given absolute address	2
HALT	Stop	1

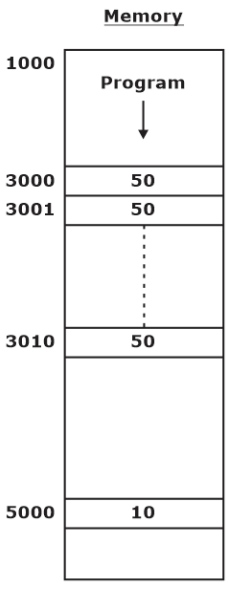
Assume that the content of the memory location 5000 is 10, and the content of the register R3 is 3000. The content of each of the memory locations from 3000 to 3010 is 50. The instruction sequence starts from the memory location 1000. All the numbers are in decimal format. Assume that the memory is byte addressable.

After the execution of the program, the content of memory location 3010 is _____.

[NAT]

Ans. 50

Sol.



At address 1004, the second instruction is present. Instruction from 2nd to 7th are in loop, loop will be terminated when R_1 becomes zero. In the first iteration value at address "3000" will be 60.

In the second iteration, value at address 3001 is 59 and so on.

At the 10th iteration the value of memory location 3009 is 51.

The value "50" remain same at address 3010. So the correct answer is "50".

13. Consider the following C code segment.

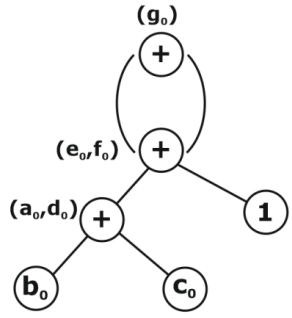
```
a = b + c;
e = a + 1;
d = b + c;
f = d + 1;
g = e + f;
```

In a compiler, this code segment is represented internally as a directed acyclic graph (DAG). The number of nodes in the DAG is _____.

[NAT]

Ans. 6

Sol.



So,Total no. of nodes = 6

Total no. of edges = 6

14. Which of the following standard C library functions will always invoke a system call when executed from a single-threaded process in a UNIX/Linux operating system?

A. strlen B. sleep

C. malloc D. exit

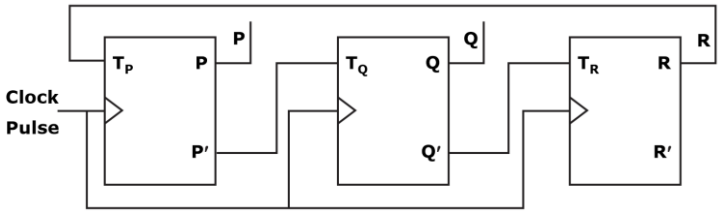
[MSQ]

Ans. B,D

Sol. Sleep (), exit () always invokes the system calls.

Strlen () and malloc () does not always invokes the system calls.

15. Consider a 3-bit counter, designed using T flip-flops, as shown below :



Assuming the initial state of the counter given by PQR as 000, what are the next three states?

A. 001, 010, 111 B. 011, 101, 000

C. 001, 010, 000 D. 011, 101, 111

[MCQ]

Ans. B

Sol.

CLK	PQR	TFF $T_P = R$	PFF $T_Q = \bar{P}$	QFF $T_R = \bar{Q}$
	0 0 0	0	1	1
1	0 1 1	1	1	0
2	1 0 1	1	0	1
3	0 0 0			

The next three states are —

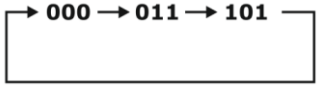
Initial : 000

1st pulse : 011

2nd pulse : 101

3rd pulse : 000

The states sequence is



16. Consider a linear list based directory implementation in a file system. Each directory is a list of nodes, where each node contains the file name along with the file metadata, such as the list of pointers to the data blocks. Consider a given directory foo.

Which of the following operations will necessarily require a full scan of foo for successful completion?

A. Opening of an existing file in foo

B. Deletion of an existing file from foo

C. Creation of a new file in foo

D. Renaming of an existing file in foo

[MSQ]

Ans. C, D

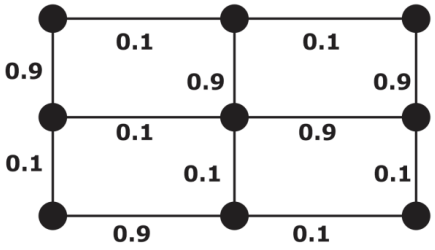
Sol. Creation of a New File: For creating new file, we've to check whether the new name is same as the existing files. Hence, the linked list must be scanned in its entirety.

Deletion of an Existing File: Deletion of a file doesn't give rise to name conflicts, hence if the node representing the files is found earlier, it can be deleted without a through scan.

Renaming a File: Can give rise to name conflicts, same reason can be given as option A.

Opening of existing file: same reason as option B.

17. Consider the following undirected graph with edge weights as shown:

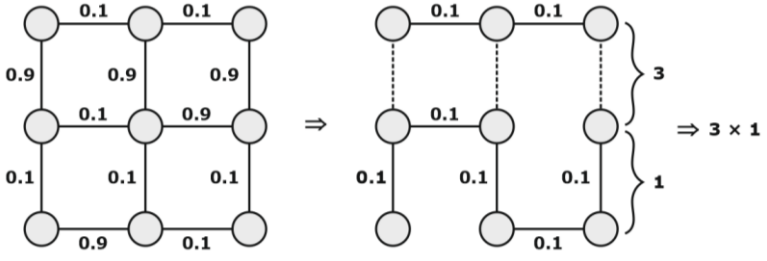


The number of minimum-spanning trees of the graph is _____.

[NAT]

Ans. 3

Sol.



18. Consider the two statements.

S_1 : There exist random variables X and Y such that $(E[(X - E(X))(Y - E(Y))])^2 > Var[X]\,Var[Y]$

S_2 : For all random variables X and Y,

$Cov[X,Y] = E[|X - E[X]||Y - E[Y]|]$

Which one of the following choices is correct?

A. Both S_1 and S_2 are true

B. S_1 is true, but S_2 is false.

C. Both S_1 and S_2 are false.

D. S_1 is false, but S_2 is true.

[MCQ]

Ans. C

Sol. $(E(X-E(X))E(Y-E(Y)))^2 > VAR[X]VAR[Y]$

$VAR[X].Var[Y] = E((X-E(X))^2)E((Y-E(Y))^2)$

If all the data is the same or equal then we have 0 on both sides of the inequality $0>0$ is false, S1 is false.

Covariance (X,Y)=E[(X-E(X))](Y-E(Y))]S2 is false.

19. The following relation records the age of 500 employees of a company, where empNo (indicating the employee number) is the key:

empAge(empNo, age)

consider the following relational algebra expression:

$\Pi_{empNo}(empAge \bowtie_{(age>age1)} \rho_{empNo1,age1}(empAge))$.

What does the above expression generate?

A. Employee numbers of all employees whose age is not the minimum.

B. Employee numbers of all employees whose age is the minimum.

C. Employee numbers of all employees whose age is more than the age of exactly one other employee.

D. Employee numbers of only those employees whose age is the maximum.

[MCQ]

Ans. A

Sol.

empAge

empNo	age	emp No 1	Age 1
1	20	1	20
2	40	2	40
3	60	3	60
×(4)	10	4	10
5	15	5	15

Emp No = 4 will not be selected because the condition age>age_1 is not satisfied for this EmpNo.

20. For a Turning machine M, $\langle M \rangle$ denotes an encoding of M. Consider the following two languages.

$L_1 = \{\langle M \rangle \mid M$ takes more than 2021 steps on all inputs$\}$

$L_2 = \{\langle M \rangle \mid M$ takes more than 2021 steps on some inputs$\}$

Which one of the following options is correct?

A. Both L_1 and L_2 are decidable.

B. L_1 is decidable and L_2 is undecidable.

C. L_1 is undecidable and L_2 is decidable.

D. Both L_1 and L_2 are undecidable.

[MCQ]

Ans. A

Sol. $L_1 = \{\langle M \rangle \mid M$ takes more than 2021 steps on an inputs$\}$

$<M> \in L_1$ if no string halts within 2021 steps

$<M> \notin L_1$ if some string halts within 2021 steps

L_1 is decidable as it can be recognized by checking all strings upto 2020 length.

$L_2 = \{<M>\}$ M takes more than 2021 steps on some input$\}$

$<M> \in L_2$ if some string takes more than 2021 steps.

$<M> \notin L_2$ if every string halts within 2021 steps

L_2 is also decidable.

21. Define Rn to be the maximum amount earned by cutting a rod of length n meters into one or more pieces of integer length and selling them. For i> 0, let p[i] denote the selling prices of a rod whose length is i meters. Consider the array of prices :

p[1] = 1, p[2] = 5, p[3] = 8, p[4] = 9, p[5] = 10, p[6] = 17, p[7] = 18

Which of the following statements is/are correct about R_7?

A. R_7 cannot be achieved by a solution consisting of three pieces.

B. R_7 = 19

C. R_7 = 18

D. R_7 is achieved by three different solutions.

[MSQ]

Ans. C, D

Sol. C & D should be correct

1st Solution :p[2];p[3];p[2]=5+8+5=18

2nd Solution :p[7]=18

3rd Solution :p[6];p[1]=17+1=18

22. Let $r_i(z)$ and $w_i(z)$ denote read and write operations respectively on a data item z by a transaction T_i. Consider the following two schedules.

S_1 : $r_1(x)$ $r_1(y)$ $r_2(x)$ $r_2(y)$ $w_2(y)$ $w_1(x)$

S_2 : $r_1(x)$ $r_2(x)$ $r_2(y)$ $w_2(y)$ $r_1(y)$ $w_1(x)$

Which one of the following options is correct?

A. S_1 is not conflict serializable, and S_2 is conflict serializable

B. Both S_1 and S_2 are conflict serializable.

C. Neither S_1 nor S_2 is conflict serializable.

D. S_1 is conflict serializable, and S_2 is not conflict serializable.

[MCQ]

Ans. A

Sol. S_1

∴ Cycle exist so not a serializable.

S_2

∴ Cycle does not exist so it is a serializable.

23. An articulation point in a connected graph is a vertex such that removing the vertex and its incident edges disconnects the graph into two or more connected components.

Let T be a DFS three obtained by doing DFS in a connected undirected graph G.

Which of the following options is/are correct?

A. Root of T is an articulation point in G if and only if it has 2 or more children.

B. A leaf of T can be an articulation point in G.

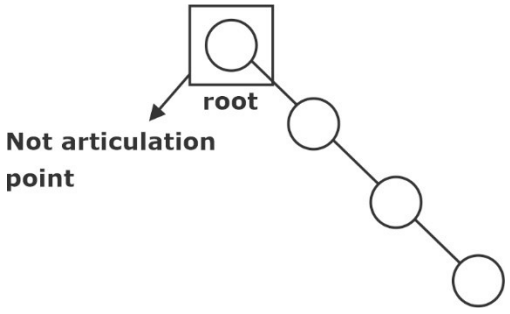
C. Root of T can never be an articulation point in G.

D. If u is an articulation point in G such that x is an ancestor of u in T and y is a descendent of u in T, then all paths from x to y in G must pass through u.

[MSQ]

Ans. A

Sol. (A) True



We need at least 2 children so that root is articulation point.

(B) False: This can never happen. Leaf will always have degree = 1.

(C) False: Check option (a) for more information.

(D) False: Below is the reasoning to show how this is false.

If 'u' is articulation point, then removing 'u' generates 2 connected components, now there might be a case when x and y will belong to either one of the connected components and hence a path will exist between them without passing through u.

Thus, Option A is correct.

24. Three processes arrive at time zero with CPU bursts of 16, 20 and 10 milliseconds. If the scheduler has prior knowledge about the length of the CPU bursts, the minimum achievable average waiting time for these processes in a non-preemptive scheduler (rounded to nearest integer) is _____ milliseconds.

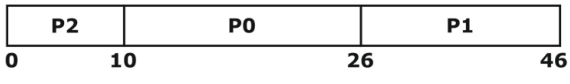
[NAT]

Ans. 12

Sol.

	AT	BT	WT
P0	0	16	10
P1	0	20	26
P2	0	10	0

Gantt chart:



Avg WT = {WT(P0) + WT(P1) + WT(P2)}/3 = {10 + 26 + 0}/3 = 36/3 = 12 ms

25. Consider the following ANSI C function:

```
int SimpleFunction(int Y[], int n, int x)
{
  int total = Y[0], loopIndex;
  for (loopIndex=1; loopIndex<= n –1; loopIndex++)
        total = x * total + y[loopIndex];
  return total;
}
```

Let Z be an array of 10 elements with Z[i]=1, for all i such that $0 \le i \le 9$. The value returned by SimpleFunction(Z, 10, 2) is _____ .

[NAT]

Ans. 1023

Sol. (1023)

4	1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1	1

n	x
10	2

$V_{ar} = 1$	Total = 1 × 2 + 1 = 3
$V_{ar} = 2$	Total = 3 × 2 + 1 = 7
$V_{ar} = 3$	Total = 7 × 2 + 1 = 15
$V_{ar} = 4$	Total = 15 × 2 + 1 = 31
$V_{ar} = 5$	Total = 31 × 2 + 1 = 63
$V_{ar} = 6$	Total = 63 × 2 + 1 = 127
$V_{ar} = 7$	Total = 127 × 2 + 1 = 255
$V_{ar} = 8$	Total = 255 × 2 + 1 = 511
$V_{ar} = 9$	Total = 511 × 2 + 1 = 1023

Final value of Total = 1023

26. Let G = (V, E) be an undirected unweighted connected graph. The diameter of G is defined as :

$$\text{diam}(G) = \max_{u,v \in V} \{\text{the length of shortest path between u and v}\}$$

Let M be the adjacency matrix of G.

Define graph G_2 on the same set of vertices with adjacency matrix N, where Define graph G_2 on the same set of vertices with adjacency matrix N, where

$$N_{ij} \begin{cases} 1 & \text{if } M_{ij} > 0 \text{ or } P_{ij} > 0, \\ 0 & \text{otherwise} \end{cases} \quad \text{where } P = M^2$$

Which one of the following statements is true?

A. $\lceil \text{diagm}(G) / 2 \rceil < \text{diam}(G_2) < \text{diam}(G)$

B. $\text{diam}(G_2) = \text{diam}(G)$

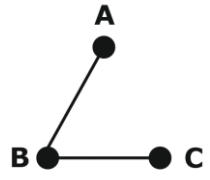
C. $\text{diam}(G) = \text{diam}(G_2) \le 2\ \text{diam}(G)$

D. $\text{diam}(G_2) \le \lceil \text{diam}(G) / 2 \rceil$

[MCQ]

Ans. D

Sol.



We have the following adj matrix for this

$$M = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$M^2 = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

$P = M^2$

Applying for formula for N

$$N = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

By looking at this we can say that we have Diameter $(G_2)=1$.

We have Diameter(G)=2.

Now by looking at these values we can eliminate options A, B, C and option D is satisfied only.

27. Consider the following three functions.

$f_1 = 10^n \quad f_2 = n^{\log n} \quad f_3 = n^{\sqrt{n}}$

Which one of the following options arranges the function in the increasing order of asymptotic growth rate?

A. f_2, f_1, f_3 B. f_3, f_2, f_1

C. f_2, f_3, f_1 D. f_1, f_2, f_3

[MCQ]

Ans. C

Sol. Take log on all functions

$\log(10^n)$, $\log(n^{\log n})$,

$\log\left(n^{\sqrt{n}}\right)$

$\Rightarrow n$, $\log n \log\log n$, $\sqrt{n}\log n$

$\Rightarrow f_2 < f_3 < f_1$

28. Consider the following matrix.

$$\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$$

The largest eigenvalue of the above matrix is _____.

[NAT]

Ans. 3

Sol. Let B = A + I

So, $B = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{pmatrix}$

All rows are identical

Only 1 independent row

So, rank of (B) = 1

Also, rank = Number of nonzero eigenvalues = 1

So, eigen values of B $\Rightarrow \lambda, 0, 0, 0$

And $\lambda + 0 + 0 + 0$ = trace = 1 + 1 + 1 + 1

So, $\lambda = 4$

$B \rightarrow 4, 0, 0, 0$

$A \rightarrow B - I \rightarrow 3, -1, -1, -1$

Maximum eigen value = 3

29. A TCP server application is programmed to listen on port number P on host S. A TCP client is connected to the TCP server over the network.

Consider that while the TCP connection was active, the server machine S crashed and rebooted. Assume that the client does not use the TCP keepalive timer.

Which of the following behaviors is/are possible?

A. If the client sends a packet after the server reboot, it will receive a FIN segment.

B. If the client sends a packet after the server reboot, it will receive a RST segment.

C. The TCP server application on S can listen on P after reboot.

D. If the client was waiting to receive a packet, it may wait indefinitely.

[MSQ]

Ans. B, C, D

Sol. Option 1 is False: Server reply with RST packet not with FIN.

Option 2 is True: When server host reboots after crashes, its TCP loses all the information about connection that existed before the crash. Therefore, the server TCP responds to the receiver data segment from the client with all RST.

Option 3 is True: TCP can listen to same port number even after reboot. For example, the HTTP server application usually listen port number 80 for incoming request so even after the reboot port 80 is assigned to HTTP.

Option D is correct.

30. Consider the following pseudocode, where S is a semaphore initialized to 5 in line #2 and counter is a shared variable initialized to 0 in line#1. Assume that the increment operation in line#7 is not atomic.

```
1. int counter = 0
2. Semaphore S = init(5);
3. void parop(void)
4. {
5. wait(S);
6. wait(S);
7. counter++;
8. signal(S);
9. signal(S);
10. }
```

If five threads execute the function parop concurrently, which of the following program behavior(s) is/are possible?

A. The value of counter is 0 after all the threads successfully complete the execution of parop.

B. The value of counter is 1 after all the threads successfully complete execution of parop.

C. The value of counter is 5 after all the threads successfully complete the execution of parop.

D. There is a deadlock involving all the threads.

[MSQ]

Ans. B, C, D

Sol.

Process A	Process B	Process C	Process D	Process E
1. Wait (s) 2. Wait (s) 3. Counter ++, 4. Signal(s) 5. Signal(s)	1. Wait (s) 2. Wait (s) 3. Counter ++, 4. Signal(s) 5. Signal(s)	1. Wait (s) 2. Wait (s) 3. Counter ++, 4. Signal(s) 5. Signal(s)	1. Wait (s) 2. Wait (s) 3. Counter ++, 4. Signal(s) 5. Signal(s)	1. Wait (s) 2. Wait (s) 3. Counter ++, 4. Signal(s) 5. Signal(s)

Initial S value = 5.

• If we take Preemption after 1st wait operation, in each process, then all process gets blocked, Hence Deadlock state.

•If all Programs complete Successfully, all counter++ statements execute and Prints value 10 after Execution.

OR

The given code allows up to 2 threads to be in the critical section as the initial value of semaphore is 5 and 2 wait operations are necessary to enter the critical section (⌈5/2⌉=2).

In the critical section the increment operation is not atomic. So, multiple threads entering the critical section simultaneously can cause race condition.

C. Assume that the 5 threads execute sequentially with no interleaving then after each thread ends the counter value increments by 1. Hence after 5 threads finish, counter value will be incremented 5 times from 0 to 5. Possible.

B. Let's assume that a process used 2 waits and reads the counter value and didn't update the value yet, all the other process let's say the other processes executed sequentially incremented and stored the value as 4 but since the value isn't written the first process yet the current value is overwritten by the first process as 1. Possible

A. There exists no pattern of execution in which the process increments the current value and completes while maintaining 0 as the counter value.Not possible

D. Assume that all the process use up the first wait operation, the semaphore value will now become zero and deadlock would've occurred. Possible

Hence Option B, C, D are correct.

31. Consider the following recurrence relation.

$$T(n) = \begin{cases} T(n/2) + T(2n/5) + 7n & \text{if } n > 0 \\ 1 & \text{if } n = 0 \end{cases}$$

Which one of the following options is correct?

A. $T(n) = \Theta((\log n)^{5/2})$

B. $T(n) = \Theta(n)$

C. $T(n) = \Theta(n\log n)$

D. $T(n) = \Theta(n^{5/2})$

[MCQ]

Ans. B

Sol. Given, recurrence relation can be written as,

$T(n) = T(n/2) + T(2n/5) + 7n$

$T(n) = T((5/2)n/5) + T(2n/5) + 7n.$

Since, sum of numerator (5/2+2 = 4.5) is less than denominator (5), so time complexity would be function itself.

Hence, $T(n) = \Theta(7n) = \Theta(n)$

32. Consider the following statements.

S_1: The sequence of procedure calls corresponds to a preorder traversal of the activation tree.

S_2: The sequence of procedure returns corresponds to a postorder traversal of the activation tree.

Which one of the following options is correct?

A. S_1 is true and S_2 is true

B. S_1 is true and S_2 is false

C. S_1 is false and S_2 is true

D. S_1 is false and S_2 is false

[MCQ]

Ans. A

Sol. S1: Function calling sequence follows Pre-order

S2: Function return sequence follows Post-order

S1: Functions will be called in the order of definition. So, It follows Pre order sequence as FIFO.

S2: The last function call, returns control to it's caller, that in turn returns to it's caller and so on. So, it is LIFO order and is Equivalent to Post order traversal.

33. Consider the following two statements.

S_1: Destination MAC address of an ARP reply is a broadcast address.

S_2: Destination MAC address of an ARP request is a broadcast address.

Which one of the following choices is correct?

A. Both S_1 and S_2 are true.

B. S_1 is true and S_2 is false.

C. S_1 is false and S_2 is true.

D. Both S_1 and S_2 are false.

[MCQ]

Ans. C

Sol. ARP request is Broadcasting

ARP reply is unicasting

So, I is False.

II is true.

34. A binary search T contains n distinct elements. What is the time complexity of picking an element in T that is smaller than the maximum element in T?

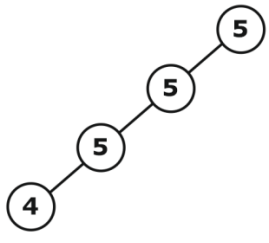
A. $\Theta(n)$ B. $\Theta(\log n)$

C. $\Theta(n \log n)$ D. $\Theta(1)$

[MCQ]

Ans. D

Sol. To find smaller than maximum element, it may take O(n) in worst case if elements are duplicate.



To find element smaller than maximum, you need to reach leaf. It takes O(n).

Note: If all elements are distinct, then time complexity is O(1).

35. A relation R is said to be circular if aRb and bRc together imply cRa.

Which of the following options is/are correct?

A. If a relation S is reflexive and symmetric, then S is an equivalence relation.

B. If a relation S is reflexive and circular, then S is an equivalence relation.

C. If a relation S is circular and symmetric, then S is an equivalence relation.

D. If a relation S is transitive and circular, then S is an equivalence relation.

[MSQ]

Ans. B

Sol. It a relation S is reflexive and circular

$\Rightarrow$ Symmetry let $(a, b) \in S$ $(a, b \in A)$

Since S is reflexive

$(b, b) \in S$

Since S is circular and $(a, b) \in S$ and $(b, b) \in S$

$(b, a) \in S$

Thus S is a symmetric relation (since $(b, a) \in S$ whenever $(a, b) \in S$)

$\Rightarrow$ Transitivity Let $(a, b) \in S$ and $(b, c) \in S$

Since S is circular :

$(c, a) \in S$

we have already shown that S is symmetric, thus let use the S is symmetric :

$(a, c) \in S$

Thus S is a transitive relation (since $(a, c) \in s$ whenever $(a, c) \in S$ and $(b, c) \in S$)

$\therefore$ S is an equivalence relation, because S is reflexive, symmetric and transitive.

36. A relation r(A, B) in a relational database has 1200 tuples. The attribute A has integer values ranging from 6 to 20, and the attribute B has integer values ranging from 1 to 20. Assume that the attribute A and B are independently distributed.

The estimated number of tuples in the output of $\sigma_{(A>10)\vee(B=18)}(r)$ is _____.

[NAT]

Ans. 820

Sol. $P(A>10)=10/15=2/3$

$P(B=18)=1/20$

$P(A>10 \wedge B=18)=2/3 \times 1/20 = 1/30$

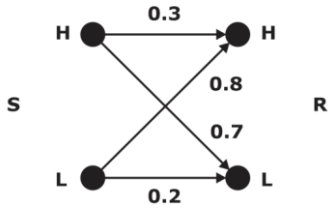
$P(A>10 \vee B=18) = P(A>10) + P(B=18) - P(A>10 \wedge B=18)$

=2/3+1/20−1/30 = (40+3−2) /60= 41/60

Thus, Estimated number of tuples = (41/60) × 1200 = 820

37. A sender (S) transmits a signal, which can be one of the two kinds: H and L with probabilities 0.1 and 0.9 respectively, to a receiver (R).

In the graph below, the weight of edge (u, v) is the probability of receiving v when u is transmitted, where u, v ∈ {H, L}. For example, the probability that the received signal is L given the transmitted signal was H, is 0.7.



If the received signal is H, the probability that the transmitted signal was H (rounded to 2 decimal places) is _____?

[NAT]

Ans. 0.04

Sol. Signal H can be received in 2 ways-

H was sent and H was received

L was sent and H was received

Thus, P(H received) = P(L sent)*P(H received/ L sent) + P(H sent)*P(H received/H sent)

= 0.9*0.8 + 0.1*0.3 = 0.75

Therefore,

P(Hsent/H received) = (P(H sent)*P(H received/H sent))/(P(L sent)*P(H received/L sent) + P(H sent)*P(H received/H sent)) = 0.03/0.75 = 0.04

38. Consider the sliding window flow-control protocol operating between a sender and a receiver over a full-duplex error-free link. Assume the following:

- The time taken for processing the data frame by the receiver is negligible.
- The time taken for processing the acknowledgement frame by the sender is negligible.
- The sender has infinite number of frames available for transmission.
- The size of the data frame is 2,000 bits and the size of the acknowledgement frame is 10 bits.
- The link data rate in each direction is 1 Mbps (= 10^6 bits per second)
- One way propagation delay of the link is 100 milliseconds.

The minimum value of the sender's window size in terms of the number of frames, (rounded to the nearest integer) needed to achieve a link utilization of 50% is _____

[NAT]

Ans. 51

Sol. $T_{\alpha(tata)} = \frac{L}{B} = \frac{2000 \text{ bits}}{10^6 \text{ bits/sec}} = 2 \times 10^{-3}$ sec = 2 Msec

$T_{\alpha(Ack)} = \frac{\text{Ack size}}{B} = \frac{10 \text{ bits}}{10^6 \text{ bits/sec}} = 10^{-5}$ sec = 10^{-2} Msec = $\frac{1}{100}$ Msec = 0.1 Msec

Efficiency (η) = $\frac{\text{use fuel time}}{\text{total time}}$

$\frac{1}{2} = \frac{N \times T_\alpha}{RTT}$

$\frac{1}{2} = \frac{N \times 2}{T_{d(data)} + 2 \times Pd + T_{d(Ack)}}$

4N = 202.01

N = 50.50

N = 51 Packet

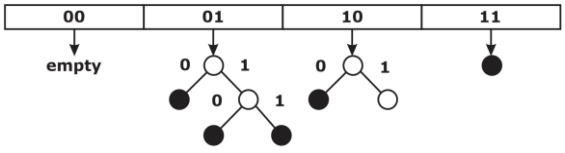
39. Consider a dynamic hashing approach for 4-bit integer keys:

1. There is a main hash table of size 4.
2. The 2 least significant bits of a key is used to index into the main hash table.
3. Initially, the main hash table entries are empty.
4. Thereafter, when more keys are hashed into it, to resolve collisions, the set of all keys corresponding to a main hash table entry is organized as a binary tree that grows on demand.
5. First, the 3rd least significant bit is used to divide the keys into left and right subtrees.

6. To resolve more collisions, each node of the binary tree is further sub-divided into left and right subtrees based on the 4th least significant bit.

7. A split is done only if it is needed, i.e., only when there is a collision.

Consider the following state of the hash table.



Which of the following sequences of key insertions can cause the above state of the hash table (assume the keys are in decimal notation)?

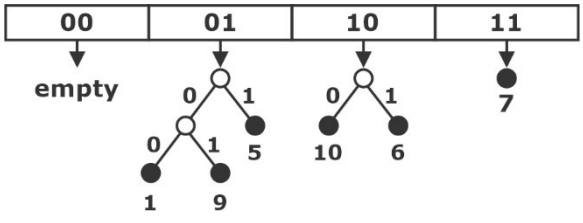
A. 9, 5, 10, 6, 7, 1 B. 9, 5, 13, 6, 10, 14

C. 10, 9, 6, 7, 5, 13 D. 5, 9, 4, 13, 10, 7

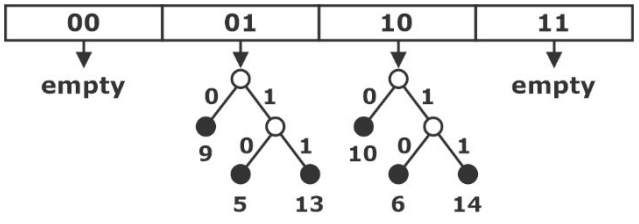
[MSQ]

Ans. C

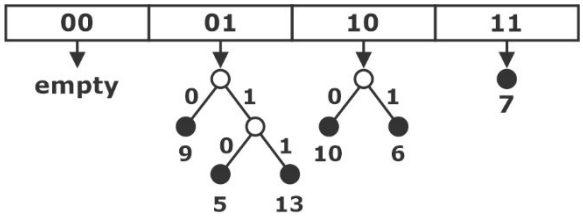
Sol. Option A:



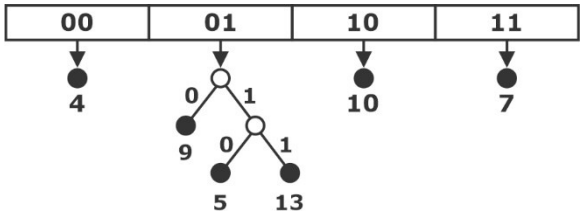
Option B:



Option C:



Option D:



Thus, C is the correct answer.

40. The lifetime of a component of a certain type is a random variable whose probability density function is exponentially distributed with parameter 2. For a randomly picked component of this type, the probability that its lifetime exceeds the expected Lifetime (rounded to 2 decimal places) is _____.

[NAT]

Ans. 0.37

Sol. $P(x) = \lambda e^{-\lambda x}$

$\lambda = 2, \quad \varepsilon(x) = \frac{1}{2} \Rightarrow 0.5$

$P\left(x \geq \frac{1}{2}\right) = e^{-\lambda_1 x} - e^{-\lambda_2 x}$

$e^{-2\times\frac{1}{2}} - 0$

$\Rightarrow e^{-1} \Rightarrow 0.3678$

41. Consider the following Boolean expression.

F = (X +Y+Z) (X' +Y) (Y' +Z)

Which of the following Boolean expressions is/are equivalent to F' (complement of F)?

A. XY' +Z' B. (X + Z') (Y' + Z')

C. (X'+Y'+ Z') (X +Y') (Y +Z') D. XY'+YZ' + X'Y'Z'

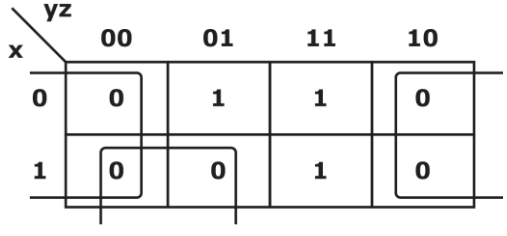
[MSQ]

Ans. A,B,D

Sol. $F = (x + y + z)\ (\bar{x} + y)(\bar{y} + z)$

$\bar{F} = \bar{x}\bar{y}\bar{z} + x\bar{y} + y\bar{z}$

We can plot 0's in K-map to get minimized.



$\bar{F} = \bar{z} + z\bar{y}$

$\bar{z} + x\bar{y}$ can also be written as

$(\bar{x} + x)(\bar{z} + \bar{y})$ using distributive law.

So, option A, B and D are correct.

42. In an undirected connected planar graph G, there are eight vertices and five faces. The number of edges in G is_____

[NAT]

Ans. 11

Sol. $|V| - |E| + |F| = 2$

Here, $|V| = 8$, $|E| = ?$, $|F| = 5$

$8 - |E| + 5 = 2$

$|E| = 11$

43. Consider the following statements.

S_1: Every SLR(1) grammar is unambiguous but there are certain unambiguous grammars that are not SLR(1).

S_2 : For any context-free grammar, there is a parser that takes at most $O(n^3)$ time to parse a string of length n.

Which one of the following options is correct?

A. S_1 is true and S_2 is false

B. S_1 is false and S_2 is false

C. S_1 is false and S_2 is true

D. S_1 is true and S_2 is true

Ans. D

Sol. S_1 : Every SLR(1) is unambiguous but there are certain unambiguous grammars that are not SLR (1).

S_1 is True.

Every SLR is unambiguous but unambiguous need not be SLR.

S_2 : For any F = G, there is a parser that takes atmost $O(n^3)$ time to parse a string of length n.

S_2 is True.

CYK algorithm exist to parse a string of length n in $O(n^3)$. Bottom-up parser exist.

44. Suppose that L_1 is a regular language and L_2 is a context-free language. Which one of the following Languages is NOT necessarily context-free?

A. $L_1 . L_2$ B. $L_1 - L_2$

C. $L_1 \cup L_2$ D. $L_1 \cap L_2$

[MCQ]

Ans. B

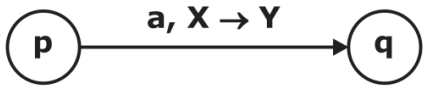
Sol. Regular ∪ CFL is CFL

Regular. CFL is CFL

Regular – CFL = Regular ∩ CFL′ = Regular ∩ CSL = Need not be CFL

Regular ∩ CFL is CFL.

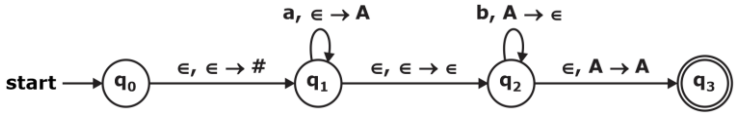
45. In a pushdown automaton $P = (Q, \Sigma, \Gamma, \delta, q_0, F)$, a transition of the form,



where $p, q \in Q$, $a \in \Sigma \cup \{\in\}$, and $X, Y \in \Gamma \cup \{\in\}$, represents

$(q, Y) \in \delta(p, a, X)$.

Consider the following pushdown automaton over the input alphabet $\Sigma = \{a,b\}$ and stack alphabet $\Gamma = \{\#, A\}$.

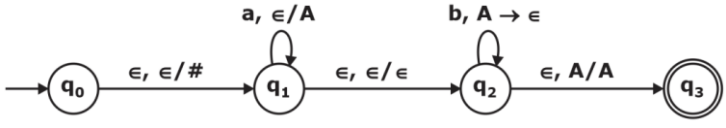


The number of strings of length 100 accepted by the above pushdown automaton is _____ .

[NAT]

Ans. 50

Sol.



Language accept by above PDA is :

$L = \{a^m b^n \mid m > n \geq 0\}$

No. of 100 lengths are accepted by given PDA :

$m + n = 100$ and $m > n \geq 0$

$m = 100, n = 0 \rightarrow a^{100}$

$m = 99, n = 1 \rightarrow a^{99}b^1$

$m = 98, n = 2 \rightarrow a^{98}b^2$

$m = 51, n = 49 \rightarrow a^{51}b^{49}$

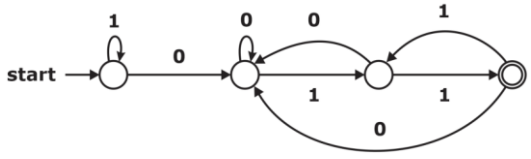
Total strings = 50

46. Consider the following language.

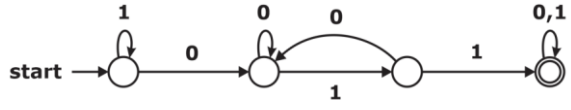
L = {w ∈ {0, 1}*|w ends with the substring 011}

Which one of the following deterministic finite automata accepts L?

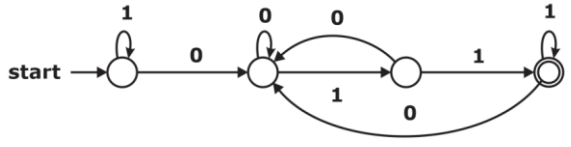
A.



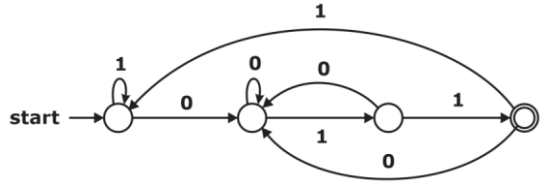
B.



C.



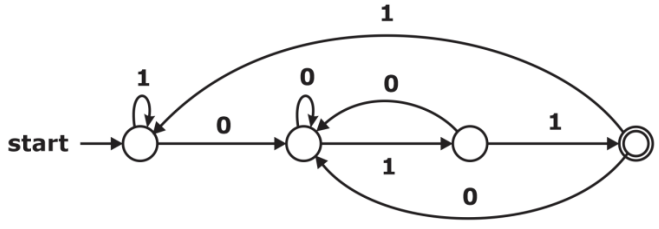
D.



[MCQ]

Ans. D

Sol. L = {w | w ∈ {0, 1}*, w ends with substring all}



47. Let the representation of a number in base 3 be 210. What is the hexadecimal representation of the number?

A. D2 B.21

C. 528 D. 15

[MCQ]

Ans. D

Sol. $(210)_3 = (\ )_{16}$

$2 \times 3^2 + 1 \times 3^1 = (21)_{10}$

16 | 21

1 – 5 ↑

$(15)_{16}$

48. A five-stage pipeline has stage delays of 150, 120, 150, 160 and 140 nanoseconds. The registers that are used between the pipeline stages have a delay of 5 nanoseconds each.

The total time to execute 100 independent instructions on this pipeline, assuming there are no pipeline stalls, is _____nanoseconds.

[NAT]

Ans. 17160

Sol. Clock cycle to be provided is

Max 150, 120, 150, 160 and 140)

Which is 160 nano-seconds.

Pipeline stage Delay = 5 nsec

Total delay for one instruction in pipeline is 165 nsec

Formula : (k + n –1) × Delay, Here K = 5, n = 100, Delay = 165

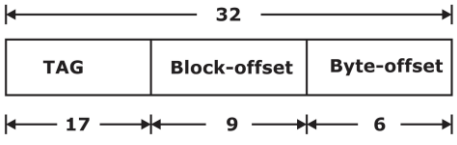
Total time = (5 + 100 – 1) × 165 = 17,160

49. Consider a computer system with a byte addressable primary memory of size 2^{32} bytes. Assume the computer system has a direct-mapped cache of size 32 KB (1 KB = 2^{10} bytes), and each cache block is of size 64 bytes. The size of the tag field is_____bits.

[NAT]

Ans. 17

Sol. For direct mapping, the address is divided as follows



Number of blocks

$$= \frac{\text{Cache size}}{\text{Block size}} = \frac{32\text{ kB}}{64\text{ B}} = \frac{2^{15}}{2^0} = 2^9$$

9 bits for block offset, 6 bits for byte offset (As it has 2^6 bytes block)

TAG = 32 – (9 + 6) = 17 bits.

50. Consider two hosts P and Q connected through a router R. The maximum transfer unit (MTU) value of the link between P and R is 1500 bytes, and between R and Q is 820 bytes.

A TCP segment of size 1400 bytes was transferred from P to Q through R, with IP identification value as 0x1234. Assume that the IP header size is 20 bytes. Further, the packet is allowed to be fragmented, i.e., Don't Fragment (DF) flag in the IP header is not set by P.

Which of the following statements is/are correct?

A. If the second fragment is lost, P is required to resend the whole TCP segment.

B. If the second fragment is lost, R will resend the fragment with the IP identification value Ox1234.

C. Two fragments are created at R and the IP datagram size carrying the second fragment is 620 bytes.

D. TCP destination port can be determined by analyzing only the second fragment.

[MSQ]

Ans. A, C

Sol.

Correct answer is A and C

If any fragment lost then sender will resend all the fragment.

Destination port address can also be obtained From the 1st Fragment.

51. Consider the following array.

23	32	45	69	72	73	89	97

Which algorithm out of the following options uses the least number of comparisons (among the array elements) to sort the above array in ascending order?

A. Merge sort

B. Insertion sort

C. Selection sort

D. Quicksort using the last element as pivot.

[MCQ]

Ans. B

Sol. If elements are already in sorted order then insertion sort takes less comparisons.

52. Suppose a database system crashes again while recovering from a previous crash. Assume checkpointing is not done by the database either during the transactions or during recovery. Which of the following statements is/are correct?

A. The system cannot recover any further.

B. The same undo and redo list will be used while recovering again.

C. The database will become inconsistent.

D. All the transactions that are already undone and redone will not be recovered again.

[MSQ]

Ans. B

Sol. Assuming undo/redo list are persistent, the answer should be B, while undo/redo system records any changes done. So, if the system crashes during recovery, the next recovery will take DB into a consistent state.

53. Consider the following sequence of operations on an empty stack.

push(54); push(52); pop(); push(55); push(62); s = pop();

Consider the following sequence of operations on an empty queue.

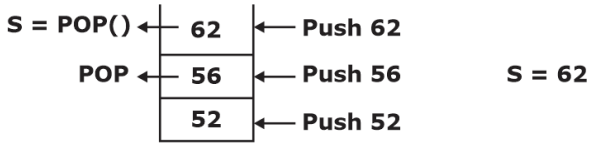
enqueue (21); enqueue (24); dequeue (); enqueue (28); enqueue (32); q = dequeue();

The value of s +q is _____.

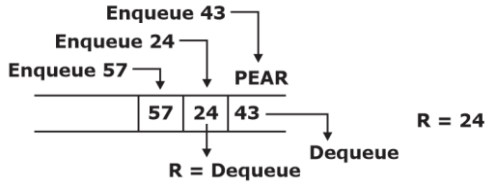
[NAT]

Ans. 86

Sol. Stack:



Queue:



S + R = 62 + 24 = 86

54. Consider the relation R(P, Q, S, T, X, Y, Z,W) with the following functional dependencies.

PQ → X; P→YX ; Q→ Y; Y → ZW

Consider the decomposition of the relation R into the constituent relations according to the following two decomposition schemes.

D_1 :R=[(P, Q, S,T); (P,T, X); (Q,Y); (Y, Z,W)]

D_2 : R= [(P, Q,S); (T, X); (Q,Y); (Y,Z,W)]

Which one of the following options is correct?

A. Both D_1 and D_2 are lossless decompositions.

B. Both D_1 and D_2 are lossy decompositions.

C. D_1 is a lossless decomposition, but D_2 is a lossy decomposition.

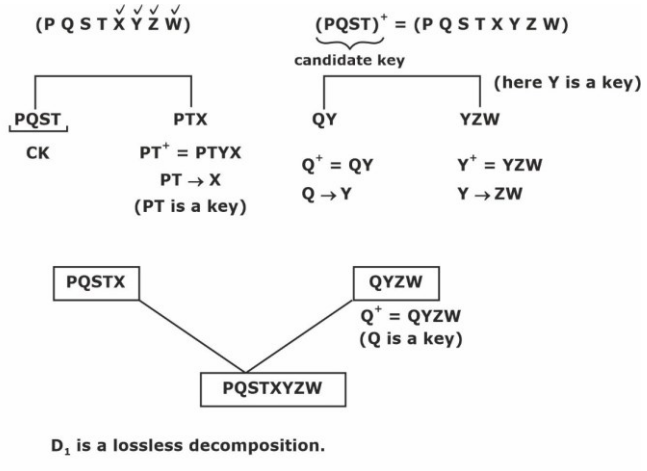
D. D_1 is a lossy decomposition, but D_2 is a lossless decomposition.

[MCQ]

Ans. C

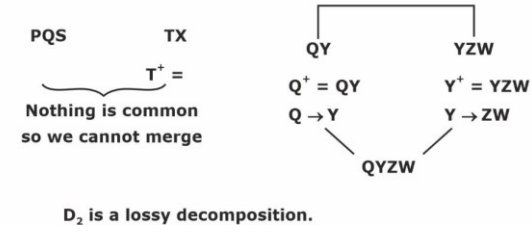
Sol. PQ →X, P→ YZ, Q → Y, Y → ZW

D1



D_1 is a lossless decomposition.

D1



D_2 is a lossy decomposition.

55. Consider the following grammar (that admits a series of declarations, followed by expressions) and the associated syntax directed translation (SDT) actions, given as pseudo-code:

P → D* E*

D → int ID {record that ID.lexeme is of type int}

D → bool ID {record that ID. lexeme is of type bool}

E → E_1 + E_2 {check that E_1.type = E_2.type = int; set E.type := int}

E → !E_1 {check that E_1 type = bool; set E.type = bool}

E → ID {set E.Type := int}

With respect to the above grammar, which one of the following choices is correct?

A. The actions can be used to type-check syntactically correct integer variable declarations and integer expressions.

B. The actions can be used to correctly type-check any syntactically correct program.

C. The actions can be used to type-check syntactically correct Boolean variable declarations and Boolean expressions.

D. The actions will lead to an infinite loop.

[MCQ]

Ans. A

Sol. E → !E_1 {If E_1.type = int then E.type bool}

Note: Here instead of int, it is given as bool.

All actions can be used to type check syntactically correct integer variable declaration and integer expressions.

****

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